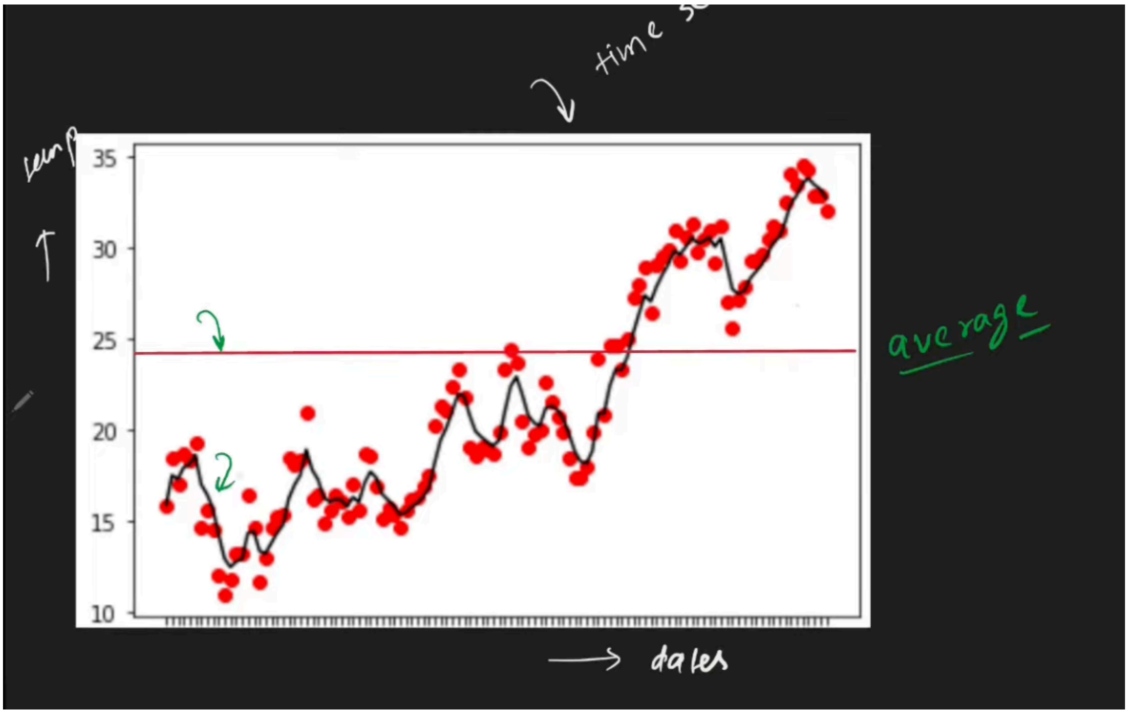
Exponentially weighted moving average



* Time series forecasting
* financial
* signal process
* Deep learning optimiser.

While calculating EWMA, we give weightage of the current time data is more than the previous one.

To find patterns in time series data.

→ previous time instance

→ constant [0,1]

$V_t = \beta V_{t-1} + (1-\beta)\theta_t$ Data at current
↳ time instance t

↓

EWMA at time t

index	temp (θ)
D_1	25
D_2	13
D_3	17
D_4	31
D_5	43

$V_0 = 0$ $\quad V_0 = \theta_0$

suppose $\beta = 0.9$

$V_1 = 0.9 \times V_0 + 0.1 \times 13$

$\Rightarrow 0.9 \times 0 + 0.1 \times 13$

$= 1.3$

$V_2 = 0.9 \times 1.3 + 0.1 \times 17 =$

$B = \frac{1}{(1-B)}$

$B \Rightarrow 0.9$

∴ Means the point will behave like average of 10 days.

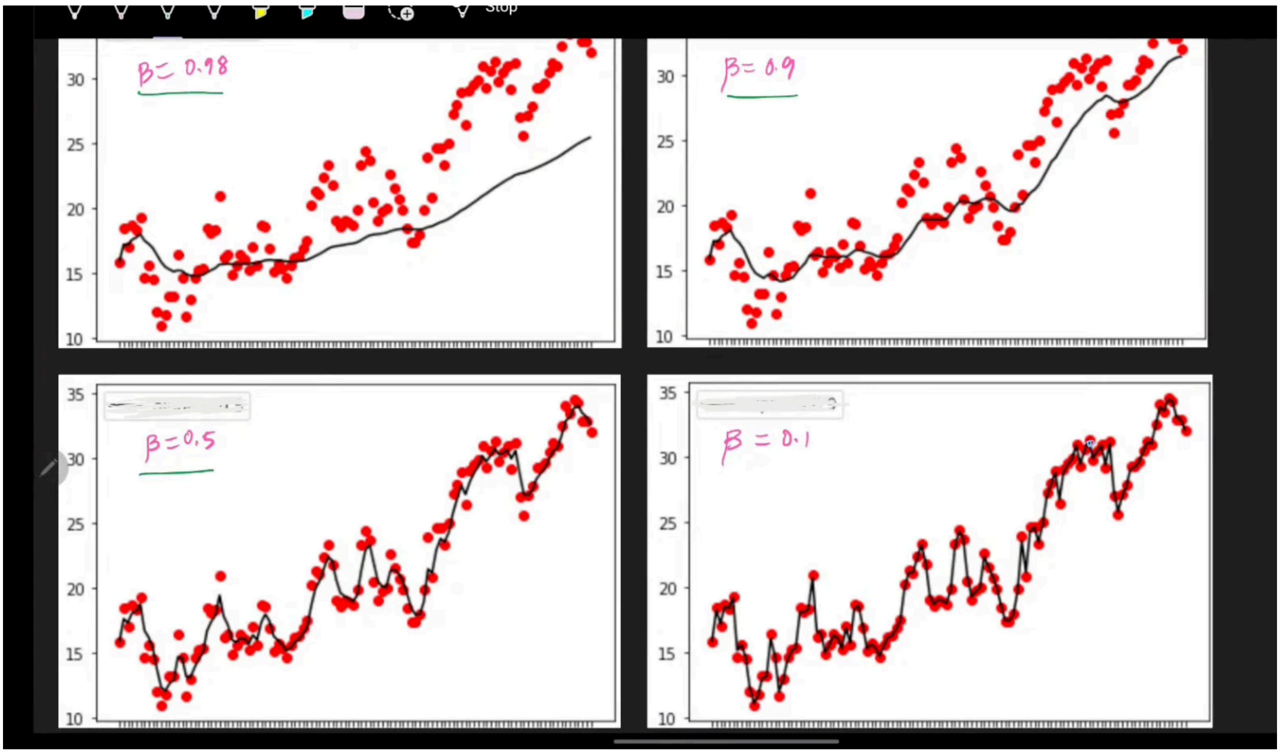
$\frac{1}{1-0.8} = \frac{0.1}{0.1}$

≈ 10

if $B = 0.5$

$\frac{10}{0.5} = 2$

∴ Normal average of previous 2 days.



so more the value of B, higher the value given to previous points.

$\therefore$ If B is very high, we are giving weightage to previous points.

Mathematical Intuition

$$V_t = B V_{t-1} + (1-B)\theta_t$$

$$V_0 = 0$$

$$V_1 = (1-B)\theta_1$$

$$V_2 = B V_1 + (1-B)\theta_2$$

$$V_2 = B(1-B)\theta_1 + (1-B)\theta_2$$

$$V_3 = B V_2 + (1-B)\theta_2$$

$$= B^2(1-B)\theta_1 + B(1-B)\theta_2 + (1-B)\theta_3$$

$$V_4 = B V_3 + (1-B)\theta_4$$

$$V_4 = B^3(1-B)\theta_1 + B^2(1-B)\theta_2 +$$

$\beta(1-\beta)\theta_3 + (1-\beta)\theta_4$

$\Rightarrow (1-\beta)\,[\underbrace{\beta^3}_{\text{weightages get low}}\theta_1 + \beta^2\theta_2 + \beta\theta_3 + \theta_4]$

$0 < \beta < 1$

$\beta^3 < \beta^2 < \beta$

alpha = $1-\beta$